

HABITAT USE BY THE LESSER FLORICAN IN A MOSAIC OF GRASSLAND AND CROPLAND: THE INFLUENCE OF GRAZING AND RAINFALL¹

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(With three text-figures)

I studied effects of grazing and rainfall on habitat use by the Lesser Florican in a mosaic of grassland and cropland. I found that the most preferred habitat of the Lesser Florican is area under grass cover. However, as a result of disturbance due to grazing, the florican may temporarily prefer crop areas. In years of drought the Lesser Florican prefers irrigated cropland as these areas have sufficient vegetation cover. When grasses grow too tall, as in years of very well distributed rains, male floricans shift their territories to areas of shorter vegetation, like soyabean fields, and mud roads.

INTRODUCTION

To reproduce successfully, birds should do so when environmental conditions are most favourable (Earle 1981). Breeding seasons are, however, fixed for most species and the degree of variability in favourable environmental factors will play a major role in breeding success. The link between rainfall and the breeding environment of birds has been documented, and nomadism, cessation or delays in breeding are characteristic adaptations of species exploiting environments with variable rainfall; the more unpredictable the rainfall, the more extreme the response (Moreau 1950, Keat and Marshall 1954, Sinclair 1978, Davies 1979, Berry and Crowe 1985, Manry 1985, DeSante and Geupel 1987). In this paper, I examine the effects of a varying monsoon and livestock grazing on the habitat use of the Lesser Florican in a mosaic of grassland and cropland.

The Lesser Florican is an endangered endemic bustard of the Indian subcontinent. It breeds during the southwest monsoon, which normally begins by end June (Jerdon 1864, Baker 1921, Dharmakumarsinhji 1950, Ali and Ripley 1969). During this period, a distinct movement into Gujarat, eastern Rajasthan and western Madhya Pradesh,

where it congregates in areas of good rainfall, has been documented (Jerdon 1864, Sankaran *et al.* 1992). The primary breeding habitat are grasslands where sufficient grass cover is available during the breeding season. In western India, these grasslands are fragmented and patchily distributed and the majority of habitat available to the Lesser Florican is a mosaic of grassland and cropland.

STUDY AREA

I studied habitat use by the Lesser Florican in the Sailana Kharmor Sanctuary (354 hectares (ha); 23° 31' N and 75° 01' E; Fig. 1) near Sailana town, Ratlam district, western Madhya Pradesh. The Sanctuary is a mosaic of grassland, cultivated fields and grazing lands and is bounded by three villages, Sailana, Adwanya and Gordhanpura. The grassland area within the Sanctuary is about 200 ha, and is owned by agriculturists, and known as the Naulakha *bheed*. The grassland is maintained and protected for its hay produce. Livestock grazing is usually permitted upto five weeks after the onset of the monsoon, the cattle thus exploit the first flush of vegetation. After this the grassland is strictly protected from grazing until the hay harvest is completed in November. Once the hay harvest is done, grazing is again permitted, and the livestock thus exploit the remaining grass stubble.

The Naulakha grassland has six main ridges and their spurs, all sloping towards the eastern corner

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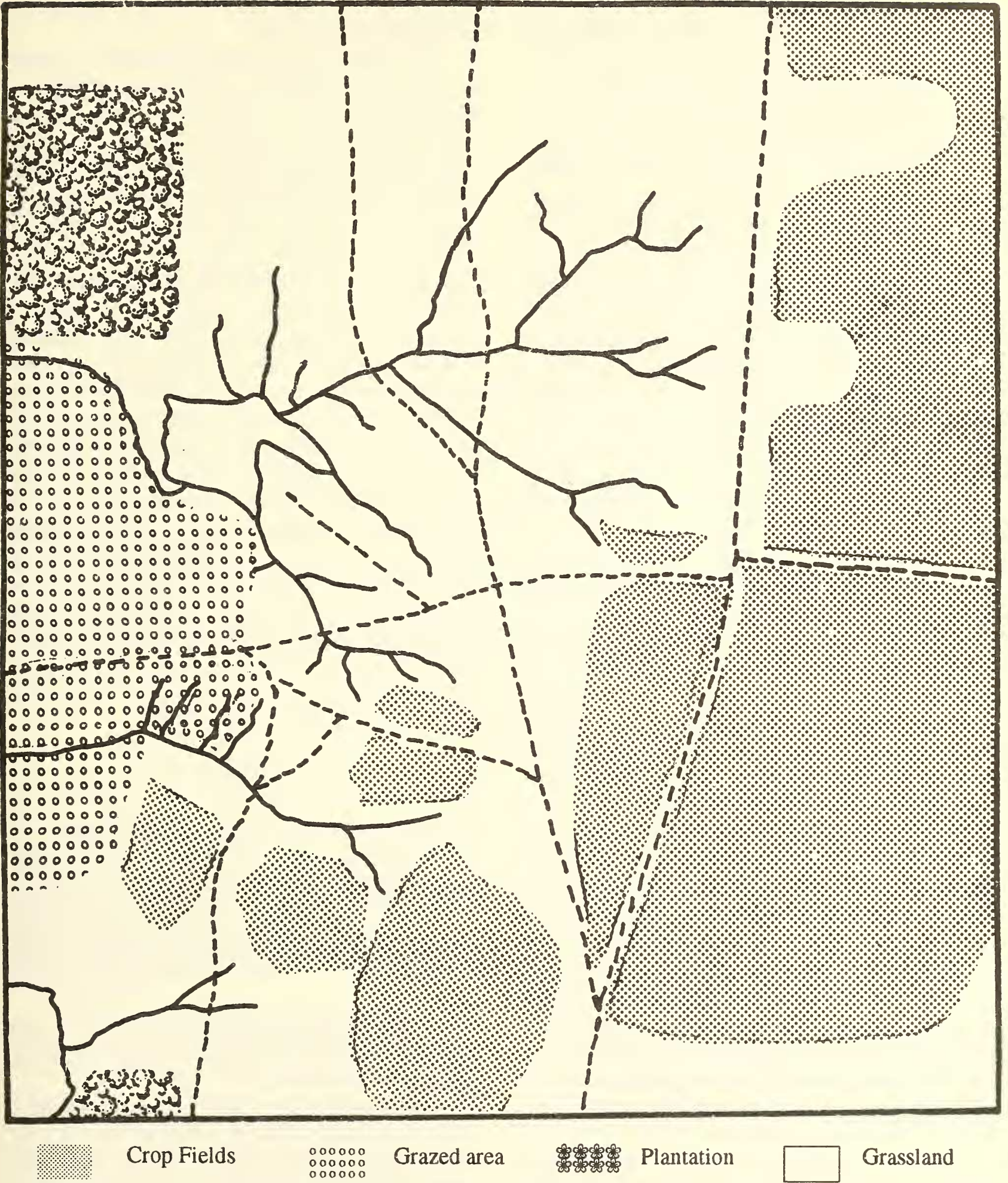


Fig. 1. Map of the Sailana Kharmor Sanctuary (Not to scale)

of the Sanctuary, where lies a perennial reservoir, Gordhansagar. The shallow valleys between the ridges channelise rainwater rivulets towards this waterbody and two other smaller reservoirs.

At the Sailana Kharmor Sanctuary, the habitat available to the Lesser Florican was of three types:

a) Grassland: This was the Naulakha grassland which covered about 200 ha of pure contiguous grassland, almost devoid of trees. The grassland area conformed to the *Sehima nervosum* - *Chrysopogon fulvus* type, that is the dominant grassland type in the Lesser Florican's breeding range. Other grasses include *Heteropogon contortus*, *Apluda mutica*, *Cymbopogon martini*, *Aristida funiculata* and species of *Bracharia*, *Eragrostis*, *Dichanthium*, *Pseudoanthesterea*, *Digitaria*, *Setaria* and *Bothriocloa*. Wild rice *Oryza rufipogon* grows where water accumulates during the monsoon. *Butea monosperma* is a common bush, rarely growing into a tree.

b) Crop fields: On the periphery of the grassland are the agricultural fields, both irrigated and rain fed, of the nearby villages. The predominant monsoon crops were Cotton *Gossypium* sp., Sorghum *Hordeum vulgare*, Maize *Zea mays*, and Soyabean *Glycine max*. In winter Wheat *Triticum aestivum*, Bengal Gram *Cicer arietinum*, Garlic *Allium sativum*, Ajma (or Ajwain) *Trachyspermum ammi* and Poppy *Papaver somniferum* were cultivated.

c) Grass patches in crop areas: These were small isolated patches of grass amidst the cultivated fields which had not yet been brought under the plough. These patches were small, ranging from 0.1 to 1.5 ha and totally occupied only about 10 to 12 ha. While grass patches should be classified under grassland, this distinction is made purely on the basis of location and size. Moreover, such a distinction is meant to contrast the use between crop fields and areas under grass cover within crop areas.

METHODS

The study extended over about 400 days between July 16 and October 6, 1985; June 22 and

October 10, 1986; June 16 and October 1, 1987; June 24 and October 6, 1988.

All habitat types in the study site were scanned to locate Lesser Florican either by sighting or flushing them. Before territories were established, such scanning of the study area was done every day, and less frequently once territories were established and males became localised. Data on Lesser Floricans thus flushed, or located, was recorded primarily as to location in the study area and habitat i.e. whether in crop field, grass patches or in the main grassland. Habitat use data was based purely on the habitat a florican was using when it was first located. Subsequent movement was not taken into account.

As habitat classes occurred in different proportions over the study areas, the data for all habitats used have been normalised by dividing the data values with weights proportionate to the area under different habitats. Thus grasslands were quantitatively weighted as 15, crop as 5 and grass patches as 1. This was then standardised by converting values into percentage of total sightings for each habitat in a fortnight. Standardisation was necessary to make the data set comparable between years because the number of birds which were sighted varied between years and there was need to eliminate bias that arose out of this.

RESULTS

Profiles of three monsoons 1986 - 1988.

1986: The monsoon began on time and the quantum was excessive (+49.03% of the normal).

1987: The monsoon was late and patchily distributed but quantum of rainfall was slightly above normal (+8.1%). Number of rainy days were 29, about -40%.

1988: The monsoon was on time and was uniformly distributed. The quantum of rainfall was above normal (+16.1%).

Maximum grass growth rates and height were seen in those years when the monsoon was on time or early (third week of June), and when rainfall was distributed throughout the season (up to October). Though 1986 had the maximum quantum of rainfall,

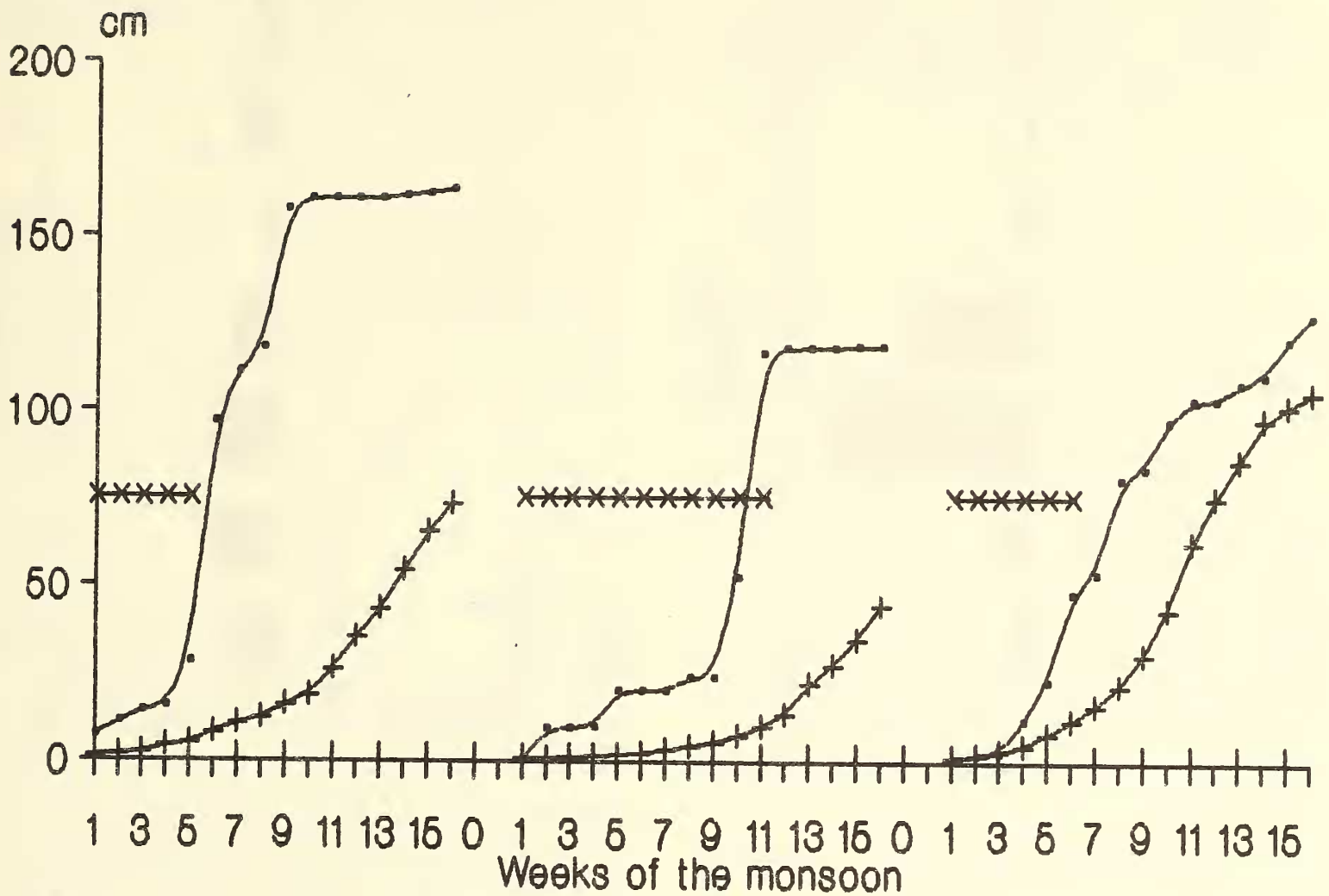


Fig. 2. Rainfall, grass growth and grazing - Naulakha grassland

—■— Cumulative rainfall —|— Grass height —x— Grazing

the distribution was restricted more or less to the first half of the season, with the latter part being dry. This resulted in lower grass growth rates and height when compared with 1988 (Fig. 2). 1987 was a drought year with late commencement of rains and patchy distribution of rainfall. The late flush of growth in 1987 resulted from a few belated heavy showers (Fig. 2).

Livestock grazing was permitted at the Naulakha grassland for the first five weeks after the onset of the monsoon and was stopped subsequent to a week of heavy rainfall. The year 1987 was an exception, and grazing continued for 11 weeks after the commencement of the monsoon, due to poor rainfall. The influence of livestock grazing during the early monsoon was similar for all years except 1987,

when grass growth rates were the lowest (Fig 2).

I found that there are significant differences in habitat use patterns in the Lesser Florican both between years, due to differences in rainfall and its effect on grass growth, and within a season, as a result of cattle grazing.

Within season changes in habitat use

In 1986, the Lesser Florican used grasslands, grass patches and crop fields in a descending order of preference (Table 1). In 1986, fortnightly shifts in habitat preference showed maximum use of grasslands in the first fortnight. In the second fortnight, floricans used all three habitats equally. In the following five fortnights both grass patches

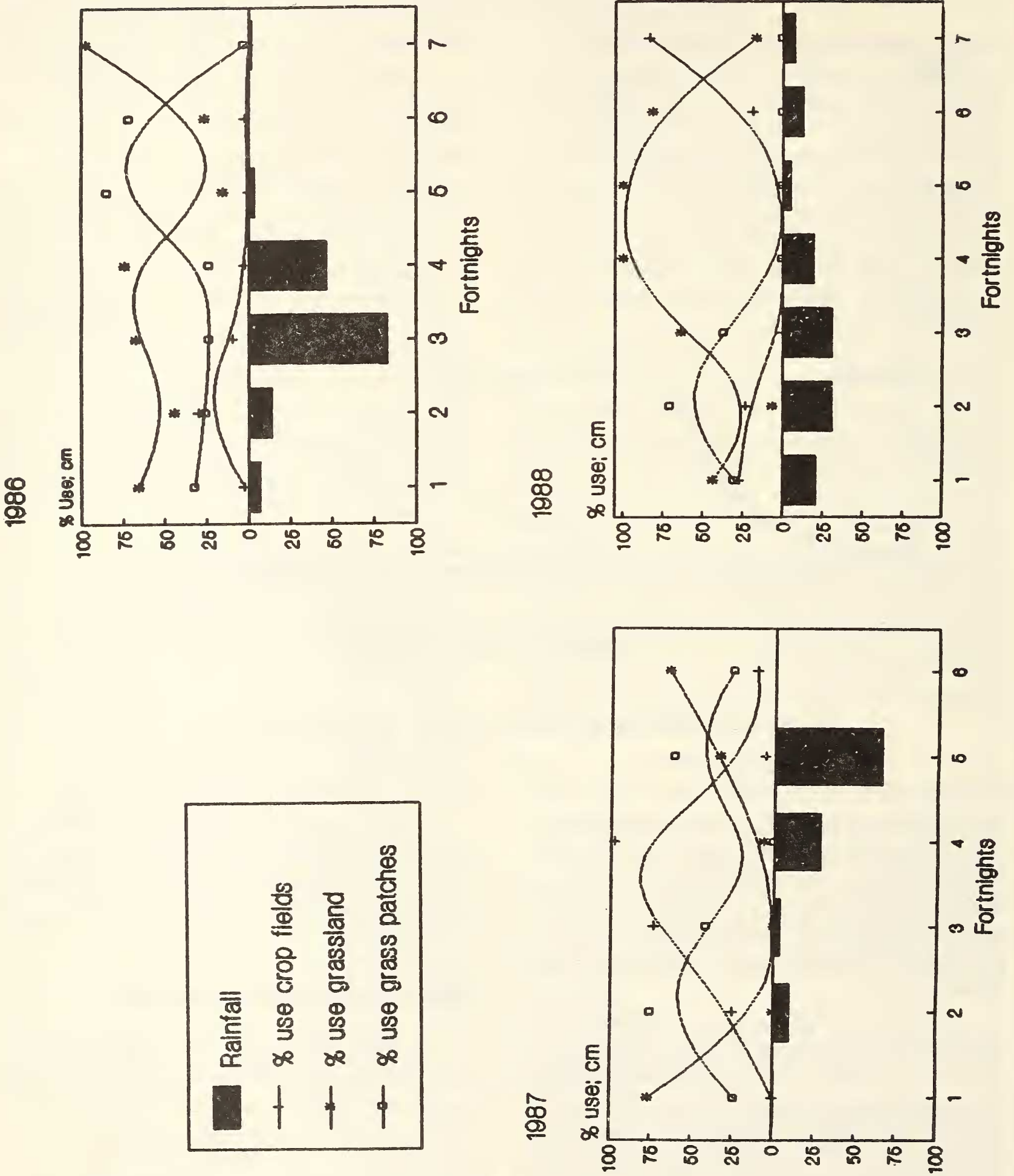


Fig. 3. Fortnightly pattern of habitat use by the Lesser florican under different monsoon conditions.

TABLE 1
VARIATION IN INTRA-YEAR HABITAT USE: 1986 TO 1988 KOLMOGROV-SMIRNOV TWO SAMPLE TEST RESULTS

		Grass		GPC	
		MD	p	MD	p
1986	Crop	0.791	<0.001	0.418	<0.001
	Grass			0.478	<0.001
1987	Crop	0.244	0.121	0.267	0.072
	Grass			0.111	0.921
1988	Crop	0.639	<0.001	0.194	0.448
	Grass			0.611	<0.001

TABLE 2
COMPARISON IN HABITAT USE PATTERNS BETWEEN FORTNIGHTS OF THE BREEDING SEASON (KOLMOGROV-SMIRNOV TWO SAMPLE TEST RESULTS)

Table 2a. 1986

		Grass		GPC	
		MD	p	MD	p
Fortnight 1	Crop	0.875	<0.001	0.375	0.520
	Grass			0.625	0.049
Fortnight 2	Crop	0.300	0.664	0.200	0.962
	Grass			0.500	0.112
Fortnight 3	Crop	0.700	0.006	0.300	0.664
	Grass			0.700	0.006
Fortnight 4	Crop	0.857	0.006	0.286	0.919
	Grass			0.714	0.047
Fortnight 5	Crop	1.000	<0.001	1.000	<0.001
	Grass			1.000	<0.001
Fortnight 6	Crop	0.900	<0.001	0.900	<0.001
	Grass			0.800	<0.001
Fortnight 7	Crop	0.909	<0.000	0.091	1.000
	Grass			0.909	<0.001

Table 2b. 1987

		Grass		GPC	
		MD	p	MD	p
Fortnight 1	Crop	1.000	<0.001	0.250	1.000
	Grass			0.750	0.125
Fortnight 2	Crop	0.250	1.000	0.500	0.500
	Grass			0.750	0.125
Fortnight 3	Crop	0.900	<0.001	0.600	0.030
	Grass			0.300	0.664
Fortnight 4	Crop	1.000	<0.001	1.000	<0.001
	Grass			0.100	1.000
Fortnight 5	Crop	0.167	1.000	0.500	0.333
	Grass			0.333	0.778
Fortnight 6	Crop	0.545	0.063	0.182	0.986
	Grass			0.545	0.063

and the main grassland were used the most and crop fields the least (Table 2 a; Fig. 3).

In 1987, all three habitats were used equally (Table 1). In the first fortnight the grassland was used more than grass patches while crop fields were not used at all. In the second fortnight all three habitats were used equally. In the third and fourth fortnights, crop fields were used almost exclusively. In the fifth fortnight all three habitats were used and in the sixth fortnight the grassland was used almost exclusively (Table 2b, Fig. 3).

In 1988, the grassland was used the most while grass patches and cropfields were used equally (Table 1). In the first two fortnights all the three habitats were used equally. In the third, fourth and fifth fortnights grasslands were used the most. In the sixth fortnight a shift was seen towards crop fields, and in the seventh fortnight crop fields were used the most (Table 2c; Fig. 3).

Between season differences in habitat use

Overall habitat use was similar in 1986 and 1988. The pattern in 1987 was different, with crop areas being used most frequently and grassland less frequently than in 1986 and 1988 (Table 3). In all three years grass patches did not show significant variation in intensity of use.

Table 2c. 1988

DISCUSSION

		Grass		GPC	
		MD	p	MD	p
Fortnight 1	Crop	0.333	0.778	0.167	1.000
	Grass			0.500	0.333
Fortnight 2	Crop	0.200	1.000	0.600	0.320
	Grass			0.800	0.080
Fortnight 3	Crop	1.000	<0.001	0.444	0.307
	Grass			0.556	0.111
Fortnight 4	Crop	1.000	<0.001	0.000	1.000
	Grass			1.000	<0.001
Fortnight 5	Crop	1.000	<0.001	0.000	1.000
	Grass			1.000	<0.001
Fortnight 6	Crop	0.750	0.125	0.250	1.000
	Grass			1.000	<0.001
Fortnight 7	Crop	1.000	<0.001	1.000	<0.001
	Grass			0.667	0.667

TABLE 3

VARIATION IN INTER-YEAR HABITAT USE IN THE LESSER FLORICAN: 1986 TO 1988. (KOLMOGROV-SMIRNOV TWO SAMPLE TEST RESULTS)

	Crop 87		Crop 88	
	MD	p	MD	p
Crop 86	0.442	<0.001	0.139	0.832
Crop 87			0.444	<0.001

	Grass 87		Grass 88	
	MD	p	MD	p
Grass 86	0.644	<0.001	0.167	0.640
Grass 87			0.667	<0.001

	GPC 87		GPC 88	
	MD	p	MD	p
GPC 86	0.178	0.440	0.111	0.961
GPC 87			0.167	0.640

Key For Tables 1 to 3

Crop = Cultivated fields

Grass = Grassland (Naulakha)

GPC = Grass patches amidst Cropfields

A lack of disturbance and vegetation cover appear to be of greatest importance in habitat selection during the breeding season of the Lesser Florican.

During the monsoon the centre of disturbance shifts in the Sailana Kharmor Sanctuary. During the early monsoon, the main grassland was the most disturbed of the three types of habitat due to the presence of livestock and graziers. In this period, crop areas are relatively undisturbed because rains, wet slushy soil and freshly sprouting crops prevent farmers from working their fields. Once grazing is stopped the grassland is undisturbed. The fields soon become disturbed as farmers begin weeding, spreading fertilizers and spraying pesticides during dry spells. Grass patches are the least disturbed of all three types as these are neither grazed nor worked upon by farmers.

Subsequent to arrival, the floricans are mainly seen in the grassland. However, as the grassland is disturbed due to grazing during the early monsoon, the floricans begin using crop areas. A reversal is seen with the cessation of grazing, and due to the absence of disturbance, the grassland becomes the most used habitat type. That the Lesser Florican use crop areas primarily due to the disturbance by livestock in the grassland, was also seen by their movement away from the grassland into crop fields at about 0800 to 0900 hours, when the cattle start arriving in the grassland, and their movement back to grassland at about 1700 to 1800 hours when the cattle start leaving the grassland.

In 1986 and 1988, both high rainfall years, there was no significant variation in habitat use patterns. On the other hand, 1987 differed significantly because of the lack of adequate cover and greater disturbance (due to an extended grazing period) in the main grassland as a result of drought. The cropfields had more vegetation cover (due to crop growth as a result of irrigation) than the grassland, and was relatively less disturbed. The few birds that were present in 1987 were seen almost exclusively in the crop fields. However, once grazing

was stopped, and late rains caused sufficient grass cover in the grassland, the floricans showed a shift towards increased use of the main grassland.

The optimal grass height range of the Lesser Florican is difficult to determine because the period of lowest grass heights coincides with grazing. However, very tall grass is not preferred by floricans, and males which had territories in the grassland shifted to crop fields or paths and mud roads within the grassland when grasses grew too tall, as was the case in 1988 when a distinct shift to crop areas was seen at the end of the breeding season.

CONCLUSION

The preferred breeding habitat of the Lesser Florican is grassland protected from livestock grazing during the monsoon. Choice of habitat, however, is determined by disturbance and, to a lesser extent, rainfall regimes. In normal years, depending on the location of greatest disturbance, birds used cultivated areas or grassland. When grazing took place in the grassland, the floricans used the crop areas more. But in cultivated areas the grass patches amidst crop fields were the preferred habitat. During

drought conditions they were, however, more frequently seen in crop fields because of more vegetation cover as a result of irrigation. When grasses grow too tall, as in years of very well distributed rains or when the grassland is very well protected, male florican shift to areas of shorter vegetation, eg. soyabean fields.

In summation, under situations where adequate vegetation cover is available, the Lesser Florican utilises habitats or areas that are least disturbed. Under drought conditions, the Lesser Florican uses habitats that has greater vegetation cover. Very tall vegetation is not preferred by the Lesser Florican.

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